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TANGL.—"Kern u. Zelltheilung bei Bildung d. Pollen," etc.; "Kerntheilung in Spirogyra" (*Sitzb. Wien.*, 1882); "Zur Lehre von d. Continuität des Protoplasm" (*Ibid.*, 1884).

TORÖK.—"Ueber die Rolle der Dotterplätchen beim Aufbau d. Gewebe," 1874.

TREUB.—"Quelques recherches sur le rôle du noyau dans la division des cellules végétaux" (*Akad. v. Wetenschap. Amsterdam*, xix., 1879).

TSCHISTIAKOFF.—"Beitr. z. Physiologie d. Pflanzenzelle" (*Bot. Zeitung*, xxxiii., 1875).

USKOFF.—"Zur Bedeutung der Karyokinesis" (*A. m. A.*, xxi., 1882).

VALETTE.—"Ueber d. Keimfleck u. die Deutung d. Eitheile" (*A. m. A.*, ii., 1866).

VINES.—Article "Reproduction" (vegetable), in Encyc. Brit.

WALDEYER.—"Eierstock und Ei," 1870.

WARNECK.—"Ueb. Bildung u. Entwickl. d. Embryos bei Gasteropoden" (*Bul. Soc. Imp. d. Naturalistes Moscou*, xxiii., 1850).

WEIL.—"Ueber d. Befruchtung u. Entwickl. d. Kaninchen Eies;" see Hoffmann and Schwalbe.

WEISSMANN.—"Beitr. z. Kennt. d. ersten Entwickl. Vorgang im Insecten Ei." Bonn, 1882.

WHITMANN.—"Embryology of Clepsine" (*Q. J. M. S.*, xviii., 1878).

WIELOWIEJSKI.—"Das Keimbläschen Stadium d. Geschlechts Kern" (*Anzeiger*, vii., 1885).

ZACHARIAS.—"Ueber Eiweiss, Nuclein u. Plastin" (*Bot. Zeits.*, 1884).

ZALEWSKI.—"Ueber Theilung d. Pollenmutter Zellen bei Liliaceen" (*Kosmos*, 1881).

ZELLER.—Obs. on Opalina (*Z. w. Z.*, xxxix., 1883).

NOTE.—The substance of what has been published under the head of Significance of Sex was originally delivered as part of a series of lectures in the spring of 1886, from random notes. In preparing the article for publication I have added historical matter and the latest literature, but the plates having been first prepared, do not contain, as they otherwise would, some of the instructive figures which accompanied this later literature.

JOHNS HOPKINS UNIVERSITY, March, 1887.

THE TACONIC QUESTION RESTATED.

BY T. STERRY HUNT.

(Continued from page 125.)

§ 15. WE have said above that Emmons, in his "Agriculture of New York," published in 1846, referred the upper portion of his Taconic to the horizon of the Calciferous Sand-rock. It is, however, important to note that in Chapter V., there devoted to the account of the "Taconic System," and previously printed separately in 1844, two years earlier, he still adhered to the opinion expressed in 1842, that the whole Taconic system was "inferior to the Potsdam sandstone," and repeated, in 1844, that "the Taconic system occupies a position inferior to the Champlain division of the New York system, or the lower division of the Silurian of Mr. Murchison." In support of this view he attempts, in 1844, to show that both the Potsdam sandstone and the Calciferous Sand-rock are found, the latter at intervals to the east of the valley of the Hudson, reposing upon the slates of the Taconic system, but adds, "probably, however, upon the Magnesian slates," which, as we have seen (§ 12), were assigned by him to a horizon below the group called by him distinctively the "Taconic slates," and were subsequently included in his Lower Taconic, the latter being Upper Taconic. In the same volume, in a subsequent chapter, which first appeared in 1846, or two years later, he had, however, arrived at the conclusion that the Calciferous Sand-rock to the eastward becomes more largely developed, and, losing the distinctive character which had given that name to the west of Lake Champlain, becomes, to use the expression of Emmons, "protean" in its modifications. Among these he now included the red sandstones of Addison, Charlotte, and Burlington, Vermont, with their interstratified red and chocolate-colored slates, besides blue limestones and gray calcareous sandstones, the whole resting upon what were designated as black Taconic slates. These so-called protean modifications of the Calciferous Sand-rock were now described by Emmons as forming an irregular belt from Canada through Eastern Vermont, thence traversing Washington, Rensselaer, Columbia, and Dutchess Counties, and crossing the Hudson into Orange County. This series, more or less interrupted in its geographical distribution, but including areas of some miles in extent, is described as "often forming the highest points in the region," and Emmons remarks, "We can hardly avoid the conclusion that this belt was once continuous, and formed an important mass overlying the Taconic slate."[1]

§ 16. It is scarcely necessary to remark that this great belt of sandstones, slates, and limestones, now described by Emmons, in 1846, as belonging to the Calciferous Sand-rock, and as resting on Taconic slates from Canada to Orange County, N. Y., is no other than the First or Transition Graywacke which, with the same geographical distribution and similar lithological characters, had long before been described by Eaton as resting unconformably upon the Transition Argillite (§ 2), and subsequently by Mather (§ 8) and (apparently) by Emmons (§ 10) had been referred to the horizon of the Second Graywacke. It will also be remembered that the Sparry Lime-rock, which we know forms an upper member of this Graywacke series, was already by Eaton, in 1832, regarded as the stratigraphical equivalent in the eastern region of what he had called the Calciferous Sand-rock to the west of Lake Champlain. Emmons had thus in 1846, after his previous statements printed in 1842 and 1844, arrived to the same conclusion as his old master, and now assigned the great mass of uncrystalline more or less fossiliferous strata, which he subsequently called Upper Taconic, to a horizon below the Trenton limestone, and regarded it as the equivalent of the Calciferous Sand-rock, including, however, as he afterwards taught, also the representative of the Potsdam sandstone. When he speaks of this great Graywacke group as resting on Taconic slates, we must remember that already in his first recognition of the superposition of Calciferous Sand-rock to Taconic slates in 1844, as above cited, he had declared these to be "probably the Magnesian slates," which correspond to the Transition Argillite of Eaton, included in the Lower Taconic, and not to what he elsewhere designates as the proper "Taconic Slate" group, which was later included in his Upper Taconic, and is no other than this same "protean" Calciferous Sand-rock and Potsdam sandstone, or the First Graywacke itself.

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[1] Agriculture of New York, vol. i. pp. 118–122.

§ 17. Emmons could scarcely have defined more clearly than he did in 1844[1] the great extent and the boundaries of this Taconic slate group as then known to him, with its breadth of fifteen or twenty miles, occupying the greater part of the three counties named in Eastern New York, and stretching from north to south one hundred and fifty or two hundred miles; its limitations on the west by the overlapping upper members of the Champlain division, and on the east by the great mass of the Sparry limestone, portions of which are said to occur at intervals in the section farther westward. He, moreover, declares in 1844, that in this Taconic slate group—described in 1842 as "often becoming a coarse graywacke" and now called "protean"—are numerous subordinate divisions, among which he mentions coarse greenish sandstones, gray sandstones, red and chocolate-colored shales, roofing-slates, green and black flinty slates, blue compact limestones, and gray silicious limestones, all of which are included in this great disturbed and faulted belt of uncrystalline strata. One of these subdivisions he described as a black slate with trilobites, and noticed another containing impressions resembling graptolites. In further proof of the fossiliferous character of this great Taconic slate group, which he had already, in 1842, referred to "the lower part of the Silurian system," he declared that besides these in the black slates just mentioned he had found fossils in the green sandstones and the green slates; while with regard to the Sparry limestones he remarks that "no fossils have yet been discovered in this rock, though it must be confessed sufficient examination has not yet been made for microscopic bivalves."

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[1] Agriculture of New York, i. 65–72. We quote from this volume for the reason that it is more generally accessible than the first and separately printed edition of the monograph.

§ 18. It is here important to remark that the term "Taconic slate" applied to this upper and notably fossiliferous portion of the Taconic system of Emmons has led to the erroneous opinion that it is in some special sense the representative of the system, and to look upon the lower members as of less significance; a view which, it is unnecessary to say, finds no countenance in the publications of Emmons. Eaton, as we have seen, asserted the existence of a stratigraphical break between the Taconic slate, his First Graywacke, and the underlying Transition Argillite. This upper unconformable portion was afterwards separated by Emmons from the inferior members of the system, and designated Upper Taconic. In his "American Geology," in 1855, he in fact proposed to consider the Taconic system as consisting of two parts, between which, according to him, "the line of demarcation is tolerably well defined." Of these, the lower part, henceforth called by him Lower Taconic, included (1) the Primitive Quartz-rock, (2) the Primitive Lime-rock, or Stockbridge limestone, and (3) the Transition Argillite, or Magnesian slate, with the lower roofing-slates. The Upper Taconic included the great group of the First Graywacke, called by Emmons, in 1842 and 1844, the Taconic slates, with the Sparry Lime-rock, called by him the Sparry limestone. This same view is again set forth by Emmons, in his "Manual of Geology" in 1860, and in his subsequent reports on the geology of North Carolina.

§ 19. It is important to note that the line of demarcation between the Lower and Upper Taconic series corresponds to the stratigraphical break already pointed out, in 1832, by Eaton between the Transition Argillite and the First Graywacke. It should be further mentioned that this division is one between a series of essentially crystalline strata below and one of earthy sediments above; and, moreover, that the facts known with regard to the distribution of the two show clearly that their areas are not co-extensive. While found superimposed upon the Lower Taconic in certain districts, the Upper Taconic is wanting over great areas of the Lower, and is elsewhere seen in many places resting unconformably upon pre-Taconian crystalline schists.

It was this Upper Taconic which Emmons, in 1842, declared to belong to "the lower part of the Silurian system," which he showed, in 1844, to contain organic remains, such as trilobites and graptolites, in several of its subdivisions of shales and sandstones, remarking that while they had not yet been found in the Sparry Lime-rock sufficient search had not been made therein. It was the same Upper Taconic or Taconic slate group which he later, in 1860, declared to correspond to the Primordial zone of Barrande, which latter was included alike by Barrande and by the other followers of Murchison, both in Europe and America, in the so-called Silurian system. Yet, notwithstanding all these facts, we find that the discovery in Eastern New York of fossils of Cambrian and Ordovician age in what J. D. Dana calls "a limestone of the original Taconic of Professor Emmons,—his Sparry Limestone,"—is brought forward in 1885 as an argument against the views of Emmons. In a letter to Marcou, dated Albany, September 1, 1860, Emmons writes, "The upper part of the Taconic is equivalent to Barrande's Primordial group," while in his "Manual of Geology," also published in 1860, he declares (p. 89) that "it has been shown that the Primordial zone in Bohemia is in co-ordination with the upper series of the Taconic rocks." In another letter to Marcou, in November of that year, he expressed the opinion that neither his Taconic system nor the Primordial zone or group of Barrande was Silurian, but in a subsequent letter, November 29, 1860, admits his misconception and writes, "On reading his [Barrande's] papers I found that, after all, his Primordial group is only Lower Silurian. I conceive that we have exactly his Primordial group in the band of slates containing the Paradoxides." (Olenellus.)[1]

§ 20. The study of these Upper Taconic rocks in the province of Quebec by the geological survey of Canada was carried on in the vicinity of the city of Quebec in 1852–1855, the present writer being at intervals an assistant to Logan in his field-work in that district. The official reports of Mather and Emmons on the geology of New York were then repeatedly consulted, and the Taconic system of the latter being then generally discredited, the passages in accordance with the views of Mather, which, as we have already noticed, are to be found on certain pages of that volume, were alone accepted, and the Graywacke series of Quebec and its vicinity was referred to the horizon of the Second Graywacke of Eaton. This great thickness of contorted shales and sandstones, with intercalated limestone and dolomite beds, already described, in 1827, by Bigsby as "a slaty series of shales and graywacke," was then called Hudson River group, and assigned to a position above the horizontal and well-characterized Utica and Trenton divisions found a very few miles away on the west side of the St. Lawrence, while the green sandstones which apparently overlie these inclined strata were designated Oneida sandstone. They were thus described and mapped in the "Esquisse Géologique du Canada," bearing the names of W. E. Logan and the present writer, but prepared by the latter, and published in Paris in 1855.

§ 21. The great belt of disturbed strata described, in 1827, by Bigsby as "a slaty series of shales and graywacke," which by the united labors of Eaton, Emmons, and Logan had now been traced with little interruption from the banks of the St. Lawrence below the city of Quebec, along the west side of Lake Champlain, and thence nearly to the Highlands of the Hudson, constituting the Upper Taconic of Emmons and the larger part of the Hudson River group of Vanuxem. That this, contrary to the teachings of Eaton, but in accordance with the views of Mather, was regarded as above, and not below, the horizon of the Trenton limestone appears, from James Hall's Report to the geological survey of Canada, published in 1857, on the graptolites of Pointe Levis, which were then described as belonging to a higher horizon than the Utica slate, and in the words of Hall, to "that part of the Hudson River group which is sometimes designated as Eaton's Sparry limestone,—being near the summit of the group." Still later, in 1859, with regard to the trilobitic strata of the town of Georgia, Vermont (the "slates with Paradoxides" of Emmons, noticed in § 19), Hall wrote, "I have the testimony of Sir William Logan that the shales of this locality are in the upper part of the Hudson River group, or form part of a series of strata which he is inclined to rank as a distinct group above the Hudson River proper."

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[1] Letter of Emmons to Marcou, November 20, 1860, in Marcou's "Taconic System."

§ 22. It was in 1856 that the finding by the present writer of an unknown trilobite in one of the many limestone bands of this Graywacke series at Pointe Levis, opposite the city of Quebec, led to further researches, revealing in that series a fauna which furnished to Billings convincing proof that the view of Eaton and Emmons was the correct one, and that this same Graywacke, or Hudson River group, was below and not above the horizon of the Trenton limestone, and was in fact the First and not the Second Graywacke of Eaton. This was first admitted by Logan in a letter to Barrande, dated December 31, 1860, but published in 1861.[1] In this, referring to the trilobitic beds in Vermont noticed above, which he had placed at the summit of the Hudson River group, but now declares that he had "recognized as equivalent to the magnesian part of the Quebec group," Logan writes, "Prof. Emmons has long maintained, on evidence that has been much disputed," that these rocks "are older than the Birdseye formation" (the basal beds of the Trenton), and adds, "the fossils which have this year been obtained at Quebec pretty clearly demonstrate that in this he is right."

Refusing, however, to adopt the name of Upper Taconic or that of the First Graywacke, Logan, for reasons of his own, chose to give to these rocks the title of the Quebec group, a name which he extended to the whole belt from the Lower St. Lawrence to the valley of the Hudson River, and henceforth made no further allusion to Emmons, whose views he had now adopted. In accordance with the teachings of Emmons in 1846 and 1855, these rocks were now declared by Logan to be a great development of sediments about the age of the Chazy and the

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[1] American Journal of Science, xxxi. 220.

Calciferous divisions of the New York system. The Red Sand-rock included in this belt in Vermont was, however, subsequently, from its fauna, referred by Billings of the Canada geological survey to a lower horizon, the so-called Lower Potsdam, and an attempt was made to establish a Potsdam group beneath the Quebec group, including both the Red Sand-rock (which Logan, in 1859, had placed above the summit of the Hudson River group) and a group of strata at Farnham in Quebec, which are, however, of Chazy if not of Trenton age.

§ 23. The subsequent history of Logan's endeavor to separate the Graywacke series, as displayed near the city of Quebec, into what he called the Levis, Lauzon, and Sillery divisions of the Quebec group, and his conjecture that the apparent order of superposition in the section there exposed represents the real or true order has been elsewhere told in detail. By his adoption of this conjecture the Levis or Sparry Lime-rock was put at the base, and the massive green Sillery sandstone at the summit of a Graywacke series of many thousand feet, all of which was but a reaffirmation of the old hypothesis of 1855, which had made this sandstone the Oneida, and the underlying gray sandstones, with shales and limestones, the equivalent of the Loraine. That this apparent order was contrary to palæontological evidence was pointed out by Billings, who insisted that the horizon of the Sparry Lime-rock, and its adjacent Phyllograptus shales, was somewhat above the typical Calciferous Sand-rock of New York, and that the massive green sandstones belonged to a much lower horizon.

Logan, although he had borrowed from Emmons the conception that the great Graywacke series was really below the horizon of the Trenton limestone, still adhered to the stratigraphical scheme which he had framed when he believed that the section at Quebec and Pointe Levis represented the Loraine shale, with a great overlying mass of green sandstones with conglomerates and red shales, corresponding to the Oneida of the New York system. These sandstones, he now thought, might correspond to the St. Peter's sandstone of the Upper Mississippi, and to the sandstones and shales which in parts of the Ottawa basin appear in the Chazy subdivision. The history of all this has been set forth in the writer's volume on "Azoic Rocks, etc."[1] The differences between Billings and Logan on these points appear in the volume of the former on "Paleozoic Fossils,"[1] and more fully in the instructive correspondence of Billings with Jewett and Marcou, lately published by the latter in his paper on the Taconic system in 1885.[2]

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[1] Second Geological Survey of Pennsylvania, Report E, 1878.

§ 24. James Hall, who had in 1857 declared that the graptolitic slates found in conjunction with the Sparry Lime-rock at Pointe Levis, the Levis limestone of Logan, were at the summit of the Hudson River group,—employing this term, as he had always done, as synonymous with Loraine shales,—was led by the palæontological discoveries in Vermont, and near the city of Quebec, to reconsider the age of this so-called group and the true significance of the term. In his "Report on the Geology of Wisconsin" in 1862 (p. 443), he referred to the evidence furnished by organic remains in the rocks of the Graywacke belt in the province of Quebec and in Vermont, "which prove conclusively that these slates are to great extent of older date than the Trenton limestone," though probably newer than the Potsdam. He remarked, moreover, that "the occurrence of well-known forms of the second fauna . . . in intimate relation with, and in beds apparently constituting a part of, the series along the Hudson River, requires some explanation. Looking critically at the localities in the Hudson valley which yield these fossils, we find them of limited and almost insignificant extent. Some of them are on the summits of elevations which are synclinal axes, . . . where the remains of new formations would naturally occur. Others are apparently unconformable to the rocks below, or are entangled in the folds of the strata, . . . while the enormous thickness of beds exposed is almost destitute of fossils." He hence concluded that the name of Hudson River group cannot properly be extended to the great mass of strata which had hitherto borne that name, but which he now regarded as distinct from "the Hudson River group proper."

§ 25. Thus while still retaining for the Loraine shales the name under which Vanuxem had, in 1842, included alike these shales and the great underlying mass of older strata belonging to two lower horizons which constitute by far the larger portion of the rocks hitherto called Hudson River group, Hall admitted the distinctness and the greater antiquity of these. In 1877, while justifying the retention of the name of Hudson River group for the fossiliferous rocks of Loraine age found along the banks of that river, and originally called "Hudson slates" by Mather,—which Hall speaks of as "the newer series, or the rocks above the Trenton limestone," as contradistinguished from the older or infra-Trenton series,—he admits that "the error lay in extending the term [Hudson River group] to rocks on the eastward, at a time when their fossil contents had not been studied . . . and their geological position had not been determined by critical examination."[1]

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[1] Geological Survey of Canada, 1865; Paleozoic Fossils, vol. i. *passim.*

[2] Proc. Amer. Acad. Sciences, New Series, vol. xii. pp. 174–256. See also therein the letters of Emmons and Marcou, pp. 184–201.

The geological position of these rocks to the eastward and their relation to the newer series had, however, already been determined, and Hall, in 1862, did but repeat the statements long before made by Emmons, who, in 1842, had declared that the Taconic slate group was undoubtedly overlapped along its western border by "the Loraine or Hudson River slates." Again, in describing, in 1846, beds of the Loraine shale alternating with the sandstone of the Gray band in the valley of the Rondout, and in their northern outcrop along the termination of the Helderberg range, Emmons declares that this section of the Loraine strata "resembles the beds which occur in patches on the east side of the Hudson along the Western [Boston and Albany] Railway. These latter beds may be clearly distinguished from the slates and shales of the Taconic system. They neither conform with them in dip nor in strike," and, except in the immediate vicinity of the great northern fracture of the Hudson valley, their dip and their disturbance are not excessive. These unconformably overlying areas of Loraine shales resting on the older Graywacke were said to form a small range between Chatham Centre and Chatham Four Corners, "where they lie in deep troughs and are exposed in the railway cuttings." In some cases, we are told, "their peculiar distribution and the confined limits of the fossiliferous beds render quite difficult the recognition of these shales when they lie in proximity to the Taconic system."[2] It was thus clearly shown by Emmons, in 1844, that the Loraine shales not only overlie the Upper Taconic or First Graywacke along its western border in New York, but are found thereon in small unconformably overlying areas, as was admitted by Hall in 1862.

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[1] Proc. Amer. Assoc. Adv. Science, 1877, p. 263.

[2] Emmons, Agriçulture of New York, pp. 124, 125, 128.

§ 26. These facts regarding the relation of the Loraine shales to the great Graywacke belt were set forth by the writer in 1878. It was at the same time shown that within the limits of this belt, in the province of Quebec and in Vermont, there were found organic forms ranging from a horizon at least as low as the Potsdam (the Olenellus or Lower Potsdam beds of Billings, which were the Paradoxides beds of Emmons) to the Phyllograptus shales (belonging to the horizon of the Arenig or Skiddaw of Great Britain), without counting the fossiliferous beds at Farnham, Quebec, assigned by Logan to the base of the Quebec group, but shown by Billings to be not lower than the Trenton. In other words, it was set forth that this First Graywacke, otherwise called the Taconic slate group, Upper Taconic and Quebec group, had been by Emmons, as long ago as 1842, declared to belong to the age of the Silurian of Murchison; that he had shown it in 1844 to contain in its various subdivisions trilobites, grapolites, and fucotids, and had in 1860 referred the same Taconic slate group to the Primordial zone, or so-called Primordial Silurian of Barrande. Still further, it was shown that it had been maintained by Emmons in 1844, and confirmed by Billings, that within this belt were accidentally included unconformable portions of post-Trenton fossiliferous strata of the Champlain division.

It was further pointed out by the writer in illustration of these facts that similar conditions appear in the basin of the Ottawa, near the city of that name, where, as the result of an unconformity between the upper and lower members of the Champlain division, a belt twenty miles long of shales and sandstones, carrying the fauna of the Utica and Loraine subdivisions, is found lying transgressively alike on the Trenton, Chazy, and Calciferous subdivisions, as long ago shown by Logan.

§ 27. The observations of Ford, Dwight, and Dale along the great Graywacke belt to the east of the Hudson, in the State of New York, which show, besides a Cambrian fauna of Potsdam and Calciferous age, the presence of small areas of strata belonging to the higher divisions of the Champlain divisions, are thus in direct confirmation of the original statements of Emmons, the later determinations of Billings, and my own teachings. They show the horizon of the Upper Taconic or Taconic slate group—the Transition or First Graywacke of Eaton—to be, as taught by Emmons in 1842, the lower part of the Silurian system, as he understood it, and as he later declared it to be, the Primordial zone or Primordial Silurian of Barrande. If, then, we except small areas of true Silurian (Lower Helderberg) and possibly Devonian strata, as at Becraft's Mountain, near Hudson, New York, and, according to James Hall (as cited by Edward Hitchcock), in Vermont, it will be seen that the great belt of Graywacke, stretching from the St. Lawrence to the Hudson River in Dutchess County, is of Cambrian age, with overlying and included patches of Ordovician (Chazy-Loraine) and a few small areas of Silurian.

It may here be added that the evident ignorance of these historical facts which is apparent therein, is the only excuse which can be pleaded for the misstatements which have of late years been repeatedly put forward with regard to this important problem in American geology.

§ 28. Marcou, who had already, in 1880, insisted thereon, declares in 1885, the "time has now come to make clear the prior right and the real advantage to be found in the use of the term 'Taconic System,' instead of the so generally employed expressions 'Cambrian' and 'Silurian,' to designate the strata enclosing the Primordial fauna.[1] In answer to this proposition, it is to be said that the names of Silurian and Cambrian were proposed for the great Transition or Graywacke series of Wales by Murchison and Sedgwick in 1835 and 1836. We need not here repeat the long history which I have elsewhere told,[2] of the means by which it was sought by Murchison to include in his Silurian the greater part of the Cambrian of Sedgwick, a task in which he was seconded by Barrande, who called the horizon of the lowest Cambrian fauna —his Primordial zone—Primordial Silurian.

In the great work of the New York geological survey, begun in 1837 and summed up in the final reports of 1842 and 1843, a succession was independently wrought out for the American palæozoic basin, in which were named the "New York System" and the "Taconic System." As regards the probable parallelism of these with the previously-named Cambrian and

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[1] The Taconic System, Proc. American Academy of Sciences, 1885, xii. 244.

[2] Hunt, History of Cambrian and Silurian, Chemical and Geological Essays, pp. 349-425.

Silurian, we find Emmons, in 1842, suggesting that the Taconic rocks in part might "be equivalent to the Lower Cambrian of Sedgwick," "the upper portion being the lower part of the Silurian System," to which the Middle and Upper Cambrian of Sedgwick were then, on the authority of Murchison, very generally referred. To repeat what we have already said, we add that this upper portion, the fossiliferous character of which he made known in 1844, was by Emmons declared, in 1860, to correspond to the Primordial of Barrande. "The upper part of the Taconic is equivalent to Barrande's Primordial zone," and again, "His Primordial group is *only Lower Silurian.* I conceive that we have exactly his *Primordial group* in the band of slates containing *Paradoxides.*"[1]

The names of Cambrian and Silurian were thus prior to that of Taconic, and so far as regards the Upper Taconic, it is now shown by palæontological studies to be unquestionably the stratigraphical equivalent of the great mass of the Cambrian of Sedgwick, including accidentally, as we have seen, small portions of his Upper Cambrian (Ordovician), but excluding, so far as yet known, the lowest Cambrian or Paradoxides horizon. It remains to be seen whether American or European geologists will abandon the accepted and well-defined terms of Cambrian for that of Taconic.

(To be concluded.)

NOTES ON THE GLACIATION OF THE PACIFIC COAST.

BY G. FREDERICK WRIGHT.

I HAVE elsewhere (see *Am. Jour. Sci.* for January) given an account of the results of my observations during last summer on the Muir Glacier, Alaska. The journey to and from that point of interest afforded equally good opportunities for observation.

The Northern Pacific Railroad passes out of the glaciated region at Sims' Station, Dakota, about forty miles west of Bismarck, at an elevation of two thousand two hundred and eighteen feet

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[1] The italics are as found in the printed text.